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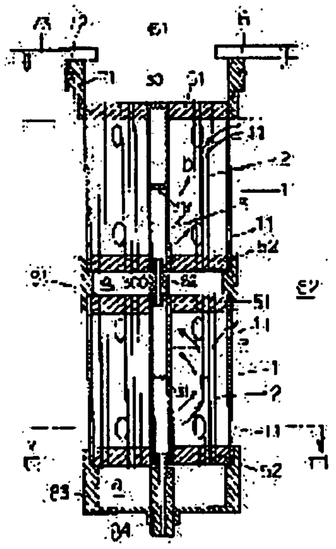
(54) VERTICAL TYPE HOLLOW FIBER MEMBRANE MODULE

(57)Abstract:
PURPOSE: To obtain a module stable for bending and torsion even when a hollow fiber membrane is washed by an air scrubbing method by providing a perforated air feed pipe in the center of an external cylinder and radially providing catchment pipes for the perforated air feed pipe.
CONSTITUTION: A perforated air feed pipe 3 is provided in the central position of a protective cylinder 1. Thereby, the pipe itself is low in mechanical strength but bending strain and torsional strain are practically regulated to the position of zero and therefore breakage is prevented. Further, catchment pipes 4 are radially provided around the perforated air feed pipe 3. Thereby, the cross-sectional secondary moment of the catchment pipes 4 is made large for bending moment and torsional moment and bending deformation and torsional deformation of a module are made small.



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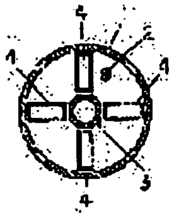

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審査請求　未請求　請求項の数２（全　４　頁）

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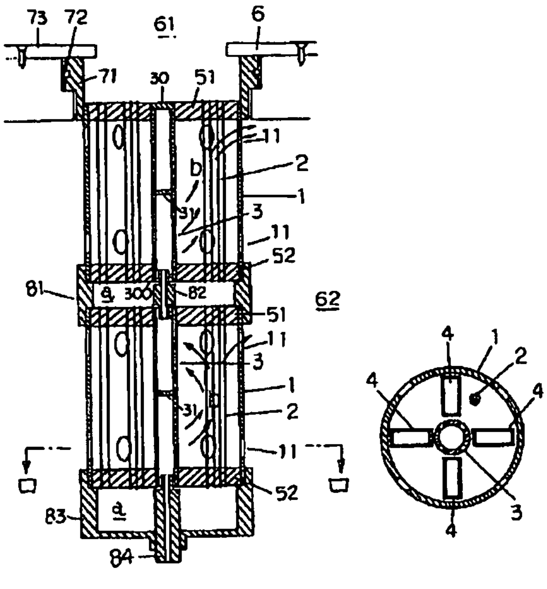
(54)【発明の名称】　縦型中空糸膜モジュール

(57)【要約】

【目的】エアスクラビング法により膜洗浄しても、モジュール全体の曲げ並びに捩じれに対する剛性を高くし、中空糸膜並びに孔開き送気管を曲げ、捩じれモーメントに対して安定に保持できる縦型中空糸膜モジュールを提供する。

【構成】外筒内に複数本の中空糸膜が両端において接着剤で両端開口の状態で固定され、中空糸膜の下端側に透過液の集水部が存在し、該集水部を中空糸膜上端側に連通する集水管の上下端が上記接着剤によって上記外筒に固定され、エアスクラビング用空気の孔開き送気管の上下端が同上接着剤によって上記外筒に固定されてなる膜モジュールにおいて、上記孔開き送気管が外筒の中央に配設され、この孔開き送気管に対し集水管が放射状に配設されている。



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【特許請求の範囲】

【請求項１】外筒内に複数本の中空糸膜が両端において接着剤で両端開口の状態で固定され、中空糸膜の下端側に透過液の集水部が存在し、該集水部を中空糸膜上端側に連通する集水管の上下端が上記接着剤によって上記外筒に固定され、エアスクラビング用空気の孔開き送気管の上下端が同上接着剤によって上記外筒に固定されてなる膜モジュールにおいて、上記孔開き送気管が外筒の中央に配設され、この孔開き送気管に対し集水管が放射状に配設されていることを特徴とする縦型中空糸膜モジュール。

【請求項２】請求項１記載の縦型中空糸膜モジュールが縦列配置され、外筒間が接続部材によって接続されると共に孔開き送気管が連通部材により連通され、各モジュールにおける孔開き送気管の途中に仕切が設けられていることを特徴とする縦型中空糸膜モジュール。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】膜モジュール中、中空糸膜モジュールにおいては、単位体積当りの膜面積を大きくとり得、また、縦型で設置することにより平面設置占有スペースを小さくできる。中空糸膜モジュールにおいては、かかる有利性のために、その用途は広範囲であり、例えば、原子力発電所、火力発電所の復水の浄化に有用である。

【０００２】図２はかかる用途に対する縦型中空糸膜モジュールの設置構造の一例を示している。図２において、M’は中空糸膜モジュールを示し、縦型保護筒１’内に複数本の中空糸膜２’と集水管４’と孔開き送気管３’とを収容し、その保護筒１’の両端にこれらの収容物２’，３’，４’の両端を両端開口状態で固定してある。ただし、上側モジュールにおける孔開き送気管３’の上端30’は閉塞してある。１１’は保護筒１’に設けた原水供給孔である。６’は耐圧容器内を透過液室６１’と原水室６２’とに仕切る管板であり、上側モジュールを水密状態で懸垂支持し、当該上側モジュールの中空糸膜上端並びに集水管上端を透過液室６１’に開通してある。８’はモジュールの接続部であり、保護筒１’，１’間を接続筒８１’で水密に接続すると共に孔開き送気管３’，３’を連通管８２’により気密に接続し、接続筒８１’内に集水室a’を形成している。９’は下側モジュールの下端のキャップ部であり、保護筒１’にキャップ９１’を水密に取着し、キャップ９１’内に集水室a’を形成し、孔開き送気管３’の下端をエア導入管９２’によりキャップ９１’外に気密に引き出してある。

【０００３】上記モジュールによって、原水を濾過するには、原水室６２’に原水を圧入し、この圧入原水を保護筒１’内に原水供給孔１１’から導入し、この導入原水を中空糸膜２’で濾過する。この濾過により生成した

透過液が中空糸膜２’内を上方向並びに下方向に向かって流動し、下方向透過液が一旦集水室a’で集水され、次いで、集水管４’により上側に導かれ、前記の直接上方向に向かって流動する透過液流れに合流され、下側モジュールにおける合流透過液は更に上側モジュールの集水管４’を通り、透過液室６１’に透過液が流入していく。

【０００４】上記において、集水管４’内の流通抵抗を中空糸膜２’内の流通抵抗に較べて著しく低くしてあり、集水管４’内での透過液の圧損を事実上、無視できるので、上記中空糸膜２’内での透過液の上下両方向への分流のために、透過液の圧損を実質上、中空糸膜長さの２分の１相当分に低減できる。

【０００５】膜モジュールにおいては、使用時間の経過と共に膜表面へのスケールの付着によってクラッドが形成され、濾過圧力の上昇、濾過速度の低下が避けらず、濾過圧力が所定圧力に達すると、膜洗浄を行う必要がある。そこで、上記の縦型中空糸膜モジュールにおいては、エア導入管９２’より孔開き送気管３’内にエアを圧入し、この圧入エアを孔開き送気管３’の孔より気泡として各モジュールの保護筒１’内の原水中に放出させ、この気泡の中空糸膜２’への衝突並びに上昇気泡によって誘起される原水の対流によって中空糸膜表面のクラッドをスクラビングし、この剥離クラッドを各モジュールの保護筒下方の原水供給孔より排出すると共に気泡を保護筒上方の原水供給孔から流出させている。

【０００６】

【発明が解決しようとする課題】しかしながら、上記の濾過装置においては、縦型中空糸膜モジュールを縦列接続してあり、長尺であって、中空糸膜に作用する動揺力のためにモーメント（曲げモーメント並びに捩じりモーメント）が発生し、特に上側モジュールにおいては、著大なモーメントが作用するため、中空糸膜並びに孔開き送気管の曲げ破損、捩じれ破損が懸念される。本発明の目的は、エアスクラビング法により膜洗浄しても、モジュール全体の曲げ並びに捩じれに対する剛性を高くし、中空糸膜並びに孔開き送気管を曲げ、捩じれモーメントに対して安定に保持できる縦型中空糸膜モジュールを提供することにある。

【０００７】

【課題を解決するための手段】本発明の縦型中空糸膜モジュールは、外筒内に複数本の中空糸膜が両端において接着剤で両端開口の状態で固定され、中空糸膜の下端側に透過液の集水部が存在し、該集水部を中空糸膜上端側に連通する集水管の上下端が上記接着剤によって上記外筒に固定され、エアスクラビング用空気の孔開き送気管の上下端が同上接着剤によって上記外筒に固定されてなる膜モジュールにおいて、上記孔開き送気管が外筒の中央に配設され、この孔開き送気管に対し集水管が放射状に配設されていることを特徴とする構成であり、縦列配

置で、外筒間を接続部材によって接続すると共に孔開き送気管を連通部材により連通して使用し、各モジュールにおける孔開き送気管の途中に仕切を設けることができる。

【０００８】

【作用】孔開き送気管においては、機械的強度が低いが、保護筒の中央位置、即ち、曲げ歪並びに捩じれ歪が実質上、零の位置に配設されているから、孔開き送気管の破損を防止できる。

【０００９】また、集水管が孔開き送気管の周囲に放射状に配設されているから、曲げモーメント並びに捩じれモーメントに対する集水管の断面二次モーメントを大にでき、モジュールの曲げ変形並びに捩じれ変形を小さくできる。

【００１０】

【実施例】以下、図面により本発明の実施例を説明する。図１の（イ）は本発明の実施例を示す断面説明図、図１の（ロ）は図１の（イ）におけるロ－ロ断面図である。図１の（イ）並びに図１の（ロ）において、１は断面円形の保護筒、１１は保護筒に設けた原水供給孔である。２は保護筒内に収納した中空糸膜、３は保護筒の中央に配設した孔開き送気管、４孔開き送気管３の周りに放射状に配設した集水管であり、曲げ、並びに捩じれに対する断面二次モーメントの大なる断面形状、例えば、四角形としてある。

【００１１】５１は保護筒１の上端に設けた接着剤層、５２は保護筒１の下端に設けた接着剤層であり、中空糸膜２、集水管４の各端を各端開口状態で保護筒１に水密に固定してある。また、孔開き送気管３に対しては、上側モジュールの孔開き送気管上端３０は閉塞し、同孔開き送気管の下端300並びに下側モジュールの両端を開口状態にして同上接着層により保護筒に水密に固定してある。３１は各孔開き送気管３の途中に設けた仕切である。

【００１２】６は圧力容器（図示せず）を上側の透過液室６１と下側の原水室６２とに仕切った管板であり、上側モジュールの上端にヘッダー７１を水密に取着し、このヘッダー７１，０リング７２、固定板７３等によってモジュールを管板６に懸垂支持してある。

【００１３】８１は上下モジュールの保護筒１，１間を接続した接続筒であり、内部に集水室ａを備えている。８２は上下モジュールの孔開き送気管３，３相互を接続した連通管である。８３は下側モジュールの下端に水密に取着したキャップであり、内部に集水室ａを備えている。８４は下側モジュールの孔開き送気管３の下端に気密に差し込み接続したエア導入管であり、キャップ８３の外部に水密に引き出してある。

【００１４】上記モジュールの膜洗浄はエアスクラビング法により行い、膜表面にスケールが付着してクラッドが形成され、濾過圧が所定値に達すると、エア導入管８４よりエアを送入する。この送入エアは下側モジュールから孔開き送気管を経て上側モジュールに送られていくが、各モジュールにおける孔開き送気管３の途中に仕切３１を設けてあるので、送入エアが下側から上側に一直線に素通りするのを排除でき、図１の（イ）の矢印ｂで示すように、送入エアを各モジュールの保護筒１内の空間によく迂回させることができる。従って、各モジュールの保護筒内での上昇気泡の発生、この上昇気泡に基づく対流の発生をよく保障でき、エアスクラビング法による膜洗浄を良好に行い得る。

【００１５】

【発明の効果】本発明の縦型中空糸膜モジュールは上述した通りの構成であり、エアスクラビング法による膜洗浄時に曲げモーメントまたは捩じりモーメントを受けても、孔開き送気管を曲げ歪並びに捩じれ歪が実質上零の部位であるモジュールの中央に配設してあるから、孔開き送気管の機械的強度が低くても孔開き送気管の破損を防止できる。

【００１６】また、集水管を孔開き送気管を中心にして放射状に配設して分散させてあるから、曲げ並びに捩じれに対する集水管の断面二次モーメントを大きくでき、モジュールの曲げ変形並びに捩じれ変形を少なくでき、機械的強度の低い膜を安定に保持できる。

【図面の簡単な説明】

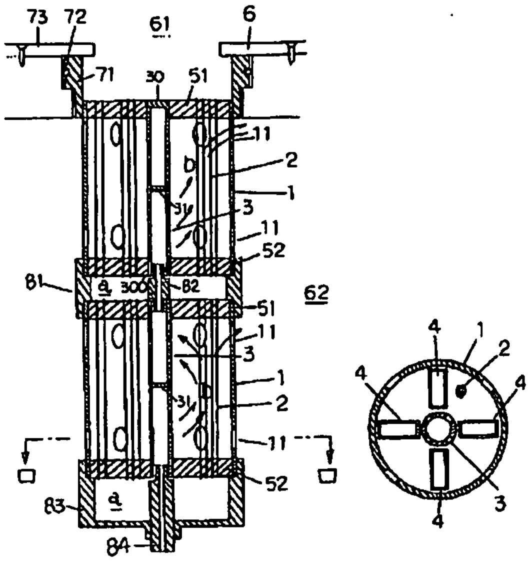
【図１】図１の（イ）は本発明の実施例を示す断面図、図１の（ロ）は図１の（イ）におけるロ－ロ断面図である。

【図２】従来例を示す断面図である。

【符号の説明】

１	保護筒
２	中空糸膜
３	孔開け送気管
３１	仕切
４	集水管
５１	接着剤層
５２	接着剤層
８１	接続筒
８２	連通管
ａ	集水室

【図1】



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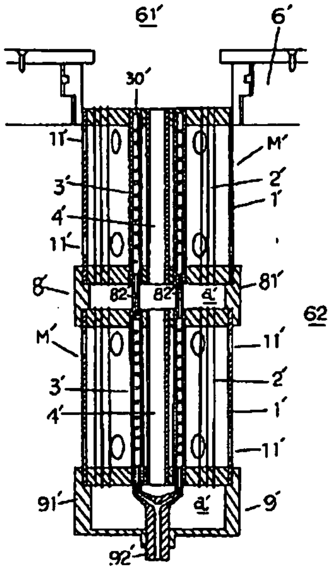
【図2】



フロントページの続き

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

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CLAIMS

[Claim(s)]

[Claim 1] Two or more hollow fibers are fixed in the state of both-ends opening with adhesives in both ends in an outer case. The catchment section of permeate liquid exists in the lower limit side of a hollow fiber, and the vertical edge of catchment tubing which opens this catchment section for free passage to a hollow fiber upper limit side is fixed to the above-mentioned outer case by the above-mentioned adhesives. In the membrane module which comes to fix the vertical edge of the hole aperture airpipe of the air for air scrubbing to the above-mentioned outer case by adhesives same as the above The vertical mold hollow fiber module characterized by arranging the above-mentioned hole aperture airpipe in the center of an outer case, and arranging catchment tubing in a radial to this hole aperture airpipe.

[Claim 2] a hole [in / column arrangement of the vertical mold hollow fiber module according to claim 1 is carried out, while between outer cases is connected by the connection member, a hole aperture airpipe is opened for free passage by the free passage member, and / each module] -- an aperture airpipe -- on the way -- the vertical mold hollow fiber module characterized by being alike and preparing the batch.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] In a hollow fiber module, a flat-surface installation occupancy tooth space can be made small among a membrane module by installing the film surface product per unit volume with the Li profit and a vertical mold as it is large. In a hollow fiber module, because of this profitableness, the application is wide range, for example, useful to purification of the condensation of a nuclear power plant and a thermal power station.

[0002] Drawing 2 shows an example of the installation structure of a vertical mold hollow fiber module to this application. drawing 2 -- setting -- M -- ' -- a hollow fiber -- a module -- being shown -- a vertical mold -- protection -- a cylinder -- one -- ' -- inside -- two or more -- a ** -- a hollow fiber -- two -- ' -- catchment -- tubing -- four -- ' -- a hole -- an aperture -- an airpipe -- three -- ' -- holding -- the -- protection -- a cylinder -- one -- ' -- both ends -- the both ends of these hold object 2', 3', and 4' -- a both-ends opening condition -- fixing -- **** . However, upper limit 30of hole aperture airpipe 3" in a top module is blockaded. 11' is the raw water feed holes prepared in protection cylinder 1'. 6' is a tube plate with which the inside of a proof-pressure container is divided into permeate liquid room 61' and raw water room 62', carries out suspension support of the top module in the watertight condition, and is opened for traffic in catchment tubing upper limit in the hollow fiber upper limit list of the top module concerned at permeate liquid room 61'. 8' -- a modular connection -- it is -- protection cylinder 1' and 1' -- while connecting between watertight by connection cylinder 81' -- hole aperture airpipe 3' and 3' -- communicating tube 82' -- airtight -- connecting -- connection cylinder 81' -- catchment room a' is formed inside. 9' -- the cap section of the lower limit of a bottom module -- it is -- protection cylinder 1' -- cap 91' -- watertight -- attaching -- cap 91' -- inside -- catchment room a' -- forming -- the lower limit of hole aperture airpipe 3' -- air installation tubing 92' -- cap 91' -- it has pulled out airtightly outside.

[0003] for filtering raw water with the above-mentioned module -- raw water room 62' -- raw water -- pressing fit -- this press fit raw water -- protection cylinder 1' -- it introduces from raw water feed-holes 11' inside, and this introductory raw water is filtered by hollow fiber 2'. the permeate liquid generated by this filtration -- hollow-fiber 2' -- unification permeate liquid [in / down permeate liquid is once caught by catchment room a', subsequently to a top, it is led by catchment tubing 4', and the permeate-liquid flow which flows toward direct above / above / is joined / inside is flowed toward down in an above list, /, and / a bottom module] -- further -- catchment tubing 4' of a top module -- a passage -- permeate-liquid room 61' -- permeate liquid -- flowing .

[0004] the above -- setting -- the circulation resistance in catchment tubing 4' -- hollow fiber 2' -- inner circulation resistance -- comparing -- remarkable -- low -- carrying out -- **** -- catchment tubing 4' -- since the pressure loss of the permeate liquid inside can be disregarded as a matter of fact -- above-mentioned hollow fiber 2' -- the pressure loss of permeate liquid can be reduced on parenchyma to the plane 1 present for 2 minutes of hollow fiber die length for splitting to the vertical both directions of the permeate liquid inside.

[0005] In a membrane module, a clad is formed of adhesion of the scale on the front face of the film with progress of a time, and if the rise of filtration pressure and the fall of filtration velocity avoid and **** and

filtration pressure reach a predetermined pressure, it is necessary to perform film washing. Then, it sets to the above-mentioned vertical mold hollow fiber module. It is made to emit into inner raw water. air installation tubing 92' -- hole aperture airpipe 3' -- inside -- air -- pressing fit -- this press fit air -- the hole of hole aperture airpipe 3' -- as air bubbles -- protection cylinder 1' of each module -- While carrying out scrubbing of the clad on the front face of a hollow fiber and discharging this exfoliation clad from the raw water feed holes of the protection cylinder lower part of each module by the convection current of raw water by which induction is carried out to the collision list to hollow fiber 2' of these air bubbles with rise air bubbles, air bubbles are made to flow out of the raw water feed holes of the protection cylinder upper part.
[0006]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned filter, in especially a top module, in order that the ****** moment may act, a hollow fiber list is anxious [column connection of the vertical mold hollow fiber module is made, and / it is a long picture, the moment (it twists in a bending moment list and is the moment) occurs for the agitation force of acting on a hollow fiber, and] about bending breakage of a hole aperture airpipe, and twist breakage. Even if the purpose of this invention carries out film washing by the air scrubbing method, it makes rigidity over a twist high at the bending list of the whole module, and is to offer the vertical mold hollow fiber module which can hold a hole aperture airpipe to stability to bending and the twist moment at a hollow fiber list.
[0007]
[Means for Solving the Problem] As for the vertical mold hollow fiber module of this invention, two or more hollow fibers are fixed in the state of both-ends opening with adhesives in both ends in an outer case. The catchment section of permeate liquid exists in the lower limit side of a hollow fiber, and the vertical edge of catchment tubing which opens this catchment section for free passage to a hollow fiber upper limit side is fixed to the above-mentioned outer case by the above-mentioned adhesives. In the membrane module which comes to fix the vertical edge of the hole aperture airpipe of the air for air scrubbing to the above-mentioned outer case by adhesives same as the above It is the configuration characterized by arranging the above-mentioned hole aperture airpipe in the center of an outer case, and arranging catchment tubing in a radial to this hole aperture airpipe. By column arrangement a hole [in / while connecting between outer cases by the connection member, a hole aperture airpipe is used being open for free passage with a free passage member, and / each module] -- an aperture airpipe -- on the way -- it can be alike and a batch can be prepared.
[0008]
[Function] although a mechanical strength is low, since it is twisted, the mid gear, i.e., the bending distorted list, of a protection cylinder, and distortion is arranged in the location of zero on parenchyma in the hole aperture airpipe -- a hole -- breakage of an aperture airpipe can be prevented.
[0009] Moreover, since catchment tubing is arranged in the perimeter of a hole aperture airpipe by the radial, it is twisted in a bending moment list, and the second moment of area of catchment tubing to the moment is made to size, it is twisted in a modular bending deformation list, and deformation can be made small.
[0010]
[Example] Hereafter, a drawing explains the example of this invention. (b) of the cross-section explanatory view in which (b) of drawing 1 shows the example of this invention, and drawing 1 is the Law RO sectional view in (b) of drawing 1 . They are the raw water feed holes which prepared 1 in the protection cylinder of a cross-section round shape, and prepared 11 in the protection cylinder in (b) of drawing 1 at the (b) list of drawing 1 . the hollow fiber which contained 2 in the protection cylinder, and the hole which arranged 3 in the center of a protection cylinder -- a second moment of area [as opposed to / are an aperture airpipe and catchment tubing arranged in the surroundings of the aperture airpipe 3 4 hole at the radial, and / a twist to bending and a list] -- size -- it has carried out to the cross-section configuration, for example, a square.
[0011] It is the adhesives layer which prepared 51 in the upper limit of the protection cylinder 1, and the adhesives layer which prepared 52 in the lower limit of the protection cylinder 1, and each edge of a hollow fiber 2 and the catchment tubing 4 is fixed to the protection cylinder 1 watertight in the state of each edge

opening. moreover, a hole -- the aperture airpipe 3 -- receiving -- the hole aperture airpipe upper limit 30 of a top module -- blockading -- said -- the both ends of a bottom module are changed into an opening condition at the lower limit 300 list of a hole aperture airpipe, and it has fixed to the protection cylinder watertight by the glue line same as the above. 31 -- each -- the hole aperture airpipe 3 -- on the way -- it is the batch boiled and prepared.

[0012] 6 is the tube plate with which the pressurized container (not shown) was divided into the upper permeate liquid room 61 and the lower raw water room 62, attaches a header 71 in the upper limit of a top module watertight, and has carried out suspension support of the module at the tube plate 6 by this header 71, zero ring 72, and stationary-plate 73 grade.

[0013] 81 is the protection cylinder 1 of a vertical module, and the connection cylinder which connected between one, and equips the interior with the catchment room a. 82 is the hole aperture airpipe 3 of a vertical module, and the communicating tube which connected both three. 83 is the cap attached in the lower limit of a bottom module watertight, and equips the interior with the catchment room a. 84 is air installation tubing which fitted over the lower limit of the hole aperture airpipe 3 of a bottom module airtightly, and was connected, and is pulled out watertight to the exterior of cap 83.

[0014] If film washing of the above-mentioned module is performed by the air scrubbing method, a scale adheres to a film front face, a clad is formed and filtration pressure reaches a predetermined value, air will be fed from the air installation tubing 84. this feeding air should pass a hole aperture airpipe from a bottom module -- the hole in each module although sent to the top module -- the aperture airpipe 3 -- on the way -- since it is alike and the batch 31 is formed, as it can eliminate that feeding air bypasses from the bottom in a straight line to the up side and the arrow head b of (b) of drawing 1 shows it, feeding air can often be detoured to the space in the protection cylinder 1 of each module. Therefore, generating of the convection current based on generating of the rise air bubbles within the protection cylinder of each module and these rise air bubbles can be secured well, and film washing by the air scrubbing method can be performed good.

[0015]

[Effect of the Invention] even if the vertical mold hollow fiber module of this invention is a configuration as mentioned above and receives the bending moment or the torsion moment at the time of film washing by the air scrubbing method -- a hole -- since an aperture airpipe is twisted in a bending distorted list and it has arranged in the modular center whose distortion is the part of parenchyma top zero -- a hole -- even if the mechanical strength of an aperture airpipe is low, breakage of a hole aperture airpipe can be prevented.

[0016] Moreover, since the radial is made to have arranged and distributed catchment tubing centering on a hole aperture airpipe, the second moment of area of catchment tubing to a twist can be enlarged at a bending list, it is twisted in a modular bending deformation list, deformation can be lessened, and the low film of a mechanical strength can be held to stability.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] In a hollow fiber module, a flat-surface installation occupancy tooth space can be made small among a membrane module by installing the film surface product per unit volume with the Li profit and a vertical mold as it is large. In a hollow fiber module, because of this profitableness, the application is wide range, for example, useful to purification of the condensation of a nuclear power plant and a thermal power station.
[0002] Drawing 2 shows an example of the installation structure of a vertical mold hollow fiber module to this application. drawing 2 -- setting -- M -- ' -- a hollow fiber -- a module -- being shown -- a vertical mold -- protection -- a cylinder -- one -- ' -- inside -- two or more -- a ** -- a hollow fiber -- two -- ' -- catchment -- tubing -- four -- ' -- a hole -- an aperture -- an airpipe -- three -- ' -- holding -- the -- protection -- a cylinder -- one -- ' -- both ends -- the both ends of these hold object 2', 3', and 4' -- a both-ends opening condition -- fixing -- **** . However, upper limit 30of hole aperture airpipe 3" in a top module is blockaded. 11' is the raw water feed holes prepared in protection cylinder 1'. 6' is a tube plate with which the inside of a proof-pressure container is divided into permeate liquid room 61' and raw water room 62', carries out suspension support of the top module in the watertight condition, and is opened for traffic in catchment tubing upper limit in the hollow fiber upper limit list of the top module concerned at permeate liquid room 61'. 8' -- a modular connection -- it is -- protection cylinder 1' and 1' -- while connecting between watertight by connection cylinder 81' -- hole aperture airpipe 3' and 3' -- communicating tube 82' -- airtight -- connecting -- connection cylinder 81' -- catchment room a' is formed inside. 9' -- the cap section of the lower limit of a bottom module -- it is -- protection cylinder 1' -- cap 91' -- watertight -- attaching -- cap 91' -- inside -- catchment room a' -- forming -- the lower limit of hole aperture airpipe 3' -- air installation tubing 92' -- cap 91' -- it has pulled out airtightly outside.
[0003] for filtering raw water with the above-mentioned module -- raw water room 62' -- raw water -- pressing fit -- this press fit raw water -- protection cylinder 1' -- it introduces from raw water feed-holes 11' inside, and this introductory raw water is filtered by hollow fiber 2'. the permeate liquid generated by this filtration -- hollow-fiber 2' -- unification permeate liquid [in / down permeate liquid is once caught by catchment room a', subsequently to a top, it is led by catchment tubing 4', and the permeate-liquid flow which flows toward direct above / above / is joined / inside is flowed toward down in an above list, /, and / a bottom module] -- further -- catchment tubing 4' of a top module -- a passage -- permeate-liquid room 61' -- permeate liquid -- flowing .
[0004] the above -- setting -- the circulation resistance in catchment tubing 4' -- hollow fiber 2' -- inner circulation resistance -- comparing -- remarkable -- low -- carrying out -- **** -- catchment tubing 4' -- since the pressure loss of the permeate liquid inside can be disregarded as a matter of fact -- above-mentioned hollow fiber 2' -- the pressure loss of permeate liquid can be reduced on parenchyma to the plane 1 present for 2 minutes of hollow fiber die length for splitting to the vertical both directions of the permeate liquid inside.
[0005] In a membrane module, a clad is formed of adhesion of the scale on the front face of the film with progress of a time, and if the rise of filtration pressure and the fall of filtration velocity avoid and **** and filtration pressure reach a predetermined pressure, it is necessary to perform film washing. Then, it sets to the above-mentioned vertical mold hollow fiber module. It is made to emit into inner raw water. air

installation tubing 92' -- hole aperture airpipe 3' -- inside -- air -- pressing fit -- this press fit air -- the hole of hole aperture airpipe 3' -- as air bubbles -- protection cylinder 1' of each module -- While carrying out scrubbing of the clad on the front face of a hollow fiber and discharging this exfoliation clad from the raw water feed holes of the protection cylinder lower part of each module by the convection current of raw water by which induction is carried out to the collision list to hollow fiber 2' of these air bubbles with rise air bubbles, air bubbles are made to flow out of the raw water feed holes of the protection cylinder upper part.

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EFFECT OF THE INVENTION

[Effect of the Invention] even if the vertical mold hollow fiber module of this invention is a configuration as mentioned above and receives the bending moment or the torsion moment at the time of film washing by the air scrubbing method -- a hole -- since an aperture airpipe is twisted in a bending distorted list and it has arranged in the modular center whose distortion is the part of parenchyma top zero -- a hole -- even if the mechanical strength of an aperture airpipe is low, breakage of a hole aperture airpipe can be prevented.
[0016] Moreover, since the radial is made to have arranged and distributed catchment tubing centering on a hole aperture airpipe, the second moment of area of catchment tubing to a twist can be enlarged at a bending list, it is twisted in a modular bending deformation list, deformation can be lessened, and the low film of a mechanical strength can be held to stability.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the above-mentioned filter, in especially a top module, in order that the ****** moment may act, a hollow fiber list is anxious [column connection of the vertical mold hollow fiber module is made, and / it is a long picture, the moment (it twists in a bending moment list and is the moment) occurs for the agitation force of acting on a hollow fiber, and] about bending breakage of a hole aperture airpipe, and twist breakage. Even if the purpose of this invention carries out film washing by the air scrubbing method, it makes rigidity over a twist high at the bending list of the whole module, and is to offer the vertical mold hollow fiber module which can hold a hole aperture airpipe to stability to bending and the twist moment at a hollow fiber list.

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MEANS

[Means for Solving the Problem] As for the vertical mold hollow fiber module of this invention, two or more hollow fibers are fixed in the state of both-ends opening with adhesives in both ends in an outer case. The catchment section of permeate liquid exists in the lower limit side of a hollow fiber, and the vertical edge of catchment tubing which opens this catchment section for free passage to a hollow fiber upper limit side is fixed to the above-mentioned outer case by the above-mentioned adhesives. In the membrane module which comes to fix the vertical edge of the hole aperture airpipe of the air for air scrubbing to the above-mentioned outer case by adhesives same as the above It is the configuration characterized by arranging the above-mentioned hole aperture airpipe in the center of an outer case, and arranging catchment tubing in a radial to this hole aperture airpipe. By column arrangement a hole [in / while connecting between outer cases by the connection member, a hole aperture airpipe is used being open for free passage with a free passage member, and / each module] -- an aperture airpipe -- on the way -- it can be alike and a batch can be prepared.

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OPERATION

[Function] although a mechanical strength is low, since it is twisted, the mid gear, i.e., the bending distorted list, of a protection cylinder, and distortion is arranged in the location of zero on parenchyma in the hole aperture airpipe -- a hole -- breakage of an aperture airpipe can be prevented.
[0009] Moreover, since catchment tubing is arranged in the perimeter of a hole aperture airpipe by the radial, it is twisted in a bending moment list, and the second moment of area of catchment tubing to the moment is made to size, it is twisted in a modular bending deformation list, and deformation can be made small.

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EXAMPLE

[Example] Hereafter, a drawing explains the example of this invention. (b) of the cross-section explanatory view in which (b) of drawing 1 shows the example of this invention, and drawing 1 is the Law RO sectional view in (b) of drawing 1 . They are the raw water feed holes which prepared 1 in the protection cylinder of a cross-section round shape, and prepared 11 in the protection cylinder in (b) of drawing 1 at the (b) list of drawing 1 . the hollow fiber which contained 2 in the protection cylinder, and the hole which arranged 3 in the center of a protection cylinder -- a second moment of area [as opposed to / are an aperture airpipe and catchment tubing arranged in the surroundings of the aperture airpipe 3 4 hole at the radial, and / a twist to bending and a list] -- size -- it has carried out to the cross-section configuration, for example, a square.
[0011] It is the adhesives layer which prepared 51 in the upper limit of the protection cylinder 1, and the adhesives layer which prepared 52 in the lower limit of the protection cylinder 1, and each edge of a hollow fiber 2 and the catchment tubing 4 is fixed to the protection cylinder 1 watertight in the state of each edge opening. moreover, a hole -- the aperture airpipe 3 -- receiving -- the hole aperture airpipe upper limit 30 of a top module -- blockading -- said -- the both ends of a bottom module are changed into an opening condition at the lower limit 300 list of a hole aperture airpipe, and it has fixed to the protection cylinder watertight by the glue line same as the above. 31 -- each -- the hole aperture airpipe 3 -- on the way -- it is the batch boiled and prepared.
[0012] 6 is the tube plate with which the pressurized container (not shown) was divided into the upper permeate liquid room 61 and the lower raw water room 62, attaches a header 71 in the upper limit of a top module watertight, and has carried out suspension support of the module at the tube plate 6 by this header 71, zero ring 72, and stationary-plate 73 grade.
[0013] 81 is the protection cylinder 1 of a vertical module, and the connection cylinder which connected between one, and equips the interior with the catchment room a. 82 is the hole aperture airpipe 3 of a vertical module, and the communicating tube which connected both three. 83 is the cap attached in the lower limit of a bottom module watertight, and equips the interior with the catchment room a. 84 is air installation tubing which fitted over the lower limit of the hole aperture airpipe 3 of a bottom module airtightly, and was connected, and is pulled out watertight to the exterior of cap 83.
[0014] If film washing of the above-mentioned module is performed by the air scrubbing method, a scale adheres to a film front face, a clad is formed and filtration pressure reaches a predetermined value, air will be fed from the air installation tubing 84. this feeding air should pass a hole aperture airpipe from a bottom module -- the hole in each module although sent to the top module -- the aperture airpipe 3 -- on the way -- since it is alike and the batch 31 is formed, as it can eliminate that feeding air bypasses from the bottom in a straight line to the up side and the arrow head b of (b) of drawing 1 shows it, feeding air can often be detoured to the space in the protection cylinder 1 of each module. Therefore, generating of the convection current based on generating of the rise air bubbles within the protection cylinder of each module and these rise air bubbles can be secured well, and film washing by the air scrubbing method can be performed good.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (b) of the sectional view in which (b) of drawing 1 shows the example of this invention, and drawing 1 is the Law RO sectional view in (b) of drawing 1 .
[Drawing 2] It is the sectional view showing the conventional example.
[Description of Notations]
1 Protection Cylinder
2 Hollow Fiber
3 Drilling Airpipe
31 Batch
4 Catchment Tubing
51 Adhesives Layer
52 Adhesives Layer
81 Connection Cylinder
82 Communicating Tube
Catchment room

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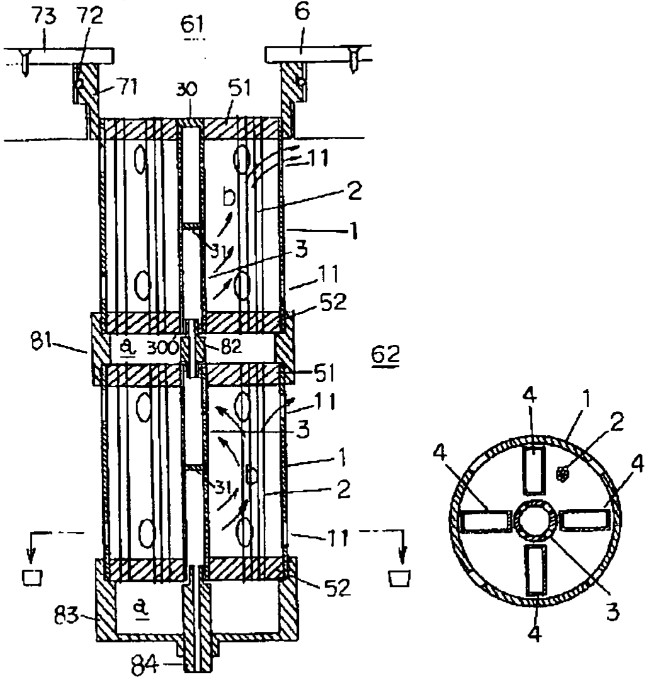
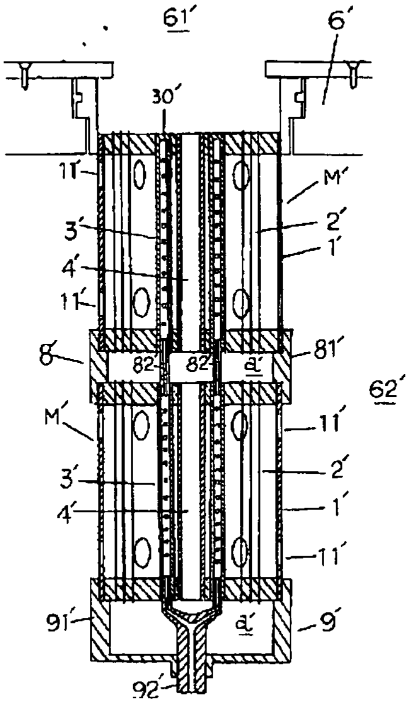
DRAWINGS

[Drawing 1]



(イ) (ロ)

[Drawing 2]



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